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Civilian Radioactive Waste Management System
Management and Operating Contractor

Title III Evaluation Report for the Subsurface Fire Water System and Subsurface Portion of the Non-Potable Water System

BA0000000-01717-5705-00004 Rev. 0

September 22, 1998

Prepared for:

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Under Contract Number
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TITLE III EVALUATION REPORT
SUBSURFACE FIRE WATER SYSTEM AND SUBSURFACE PORTION OF THE NON-POTABLE WATER SYSTEM
(BABFAH000-Subsurface Fire Water)
(BABFAE000-Subsurface Non-Potable Water)

1. OBJECTIVE

1.1 Introduction

This Title III Evaluation Report (TER) provides the results of an evaluation that was conducted on the Subsurface Fire Water System (SFWS) and the Subsurface portion of the Non-Potable Water System (SNPWS). This TER has been written in accordance with the Technical Document Preparation Plan for the Mined Geologic Disposal System Title III Evaluation Reports (BA0000000-01717-4600-00005 REV 03).

1.2 Objective

The objective of this evaluation is to provide recommendations to ensure consistency between the technical baseline requirements, baseline design, and the as-constructed SFWS/SNPWS. Recommendations for resolving discrepancies between the as-constructed systems, the technical baseline requirements, and the baseline design are included in this report. Cost and schedule estimates are provided for all recommended modifications.

This report does not address items which do not meet current safety or code requirements. These items are identified to the CMO and immediate action is taken to correct the situation. The report does identify safety and code items for which the A/E is recommending improvements. The recommended improvements will exceed the minimum requirements of applicable code and safety guidelines. These recommendations are intended to improve and enhance the operation and maintenance of the facility.

1.3 Methodology

The methodology used in the Title III Evaluation Reports of the SFWS/SNPWS consists of the following activities:

- field investigation to inspect the Subsurface as-constructed systems;

- comparison of the as-constructed system with the ESF design requirements (e.g. ESFDR, operational requirements, and S&H requirements) to determine if the as-constructed system satisfies the requirements;

- a review of Level 3 design documents, field investigation data, and as-constructed documentation to determine deviations between the design and as-constructed SFWS/SNPWS;

- a review of operational requirements to determine if the as-constructed system is capable of performing/supporting the operational requirements; and

- development of recommendations to resolve discrepancies.

2. SCOPE

This TER covers SFWS/SNPWS including the location of portable fire extinguishers. The function of SFWS/SNPWS is to transfer non potable water from the Surface facilities for use as construction water and fire suppression in the event of a fire in the Subsurface facilities during construction and operation phases of the ESF. The SFWS/SNPWS consists of piping, three tracer feed tanks, three circulating pumps, high pressure flexible hoses, valves, fire pump, meter, fire hose stations, portable extinguishers, and controls and instrumentation. This system is located within the boundaries defined by the North and the South portals within the ESF.

The three tracer feed tanks, three circulating pumps, meter, and associated piping/valves and instrumentation are located on the north portal pad. The fire pump, high-pressure flexible hoses, fire hose stations, portable extinguishers, and associated piping/valves and instrumentation are located underground in the main drift and alcoves.

The Surface/Subsurface interface for the as-constructed system is at the fire hydrant (Item 23, Reference 9.1) at location N765042.80 and E570040.41.

3. QUALITY ASSURANCE

The purpose of this TER is not to implement QA controls associated with the SFWS/SNPWS. Rather, this document identifies those QA controls which continue to be applicable to the operation of the system. The implementation of QA controls are specifically addressed in the design drawings and specifications for the SFWS and SNPWS.

This evaluation does not comprise a QA design input. The Systems, Structures, and Components (SSCs) to which it applies are not classified in accordance with QAP-2-3, *Classification of Permanent Items*, and do not rely on or incorporate any QA controls identified within any applicable Determination of Importance Evaluation (DIE). Preparation of this evaluation is not subject to *Quality Assurance Requirements and Description* (QARD) requirements. QA: None.

The as-constructed SFWS/SNPWS complies with the QA control requirements of Specification Sections 1500, 1501, and 1502.

4. FIELD INSPECTION

4.1 Summary: Two field inspections were performed by walking the Subsurface as-constructed systems. The inspections included visually checking the SFWS/SNPWS piping inside and outside the tunnel, Subsurface fire pump, Subsurface fire hose stations, Subsurface fire extinguisher locations, and the pipe interface of the Subsurface and Surface piping. Data was recorded and reviews of the design drawing were performed during the field inspections. This TER is based on the information gathered during the two inspections.

4.2	Date:	February 12, 1997	April 15, 1997
4.3	Participants:	Larry Morrison Augustin Passalacqua Ben Teheranian	Michael Heiner Hector Montalvo Tony Saltikov Gary Teraoka

4.4 Records Reviewed:

Kiewit/PB Drawing Numbers:

- tunaba.dwg: ESF-TS North Ramp Utilities - As-Built STA 0+00 to 5+00
- tunabb.dwg: ESF-TS North Ramp Utilities - As-Built STA Alcove #1-Alcove #2
- tunabc.dwg: ESF-TS North Ramp Utilities - As-Built STA 5+00 to 10+00
- tunabd.dwg: ESF-TS North Ramp Utilities - As-Built STA 10+00 to 15+00
- tunabf.dwg: ESF-TS North Ramp Utilities - As-Built STA Alcove #3 - Alcove #4
- tunabg.dwg: ESF-TS North Ramp Utilities - As-Built STA 15+00 to 20+00
- tunabh.dwg: ESF-TS North Ramp Utilities - As-Built STA 20+00 to 25+00
- tunabi.dwg: ESF-TS North Ramp Utilities - As-Built STA 25+00 to 30+00

tunabj.dwg:	ESF-TS North Ramp Utilities - As-Built STA Alcove #5
tunabk.dwg:	ESF-TS North Ramp Utilities - As-Built STA 30+00 to 35+00
tunabl.dwg:	ESF-TS North Ramp Utilities - As-Built STA 35+00 to 40+00
tunabm.dwg:	ESF-TS North Ramp Utilities - As-Built STA Alcove #6
tunabn.dwg:	ESF-TS North Ramp Utilities - As-Built STA 40+00 to 45+00
tunabo.dwg:	ESF-TS North Ramp Utilities - As-Built STA 45+00 to 50+00
Tunnel2.dwg:	ESF Tunnel Progress

REECO Sketches

File Name: YMPFWLN2.DWG:	Fire Water Line As-Built Locations
File Name: ESF1095A.DWG:	ESF Pad Working Drawing

M&O Drawing Numbers:

BABFD0000-01717-2100-20028 Rev. 05	North Portal Pad Utility Plan
BABBD0000-01717-2100-20030 Rev. 05	North Portal Pad Utility Plan
BABEAC000-01717-2100-47770 Rev 01	TS North Ramp Piping Brackets Plan, Elevations, Details
BABEAC000-01717-2100-41111 Rev 01	TS North Ramp Piping Brackets Installation
BABFAE000-01717-2100-45301 Rev 01	Subsurface Water Distribution System Flow Diagram
BABFA0000-01717-2100-45304 Rev 01	SS/Surf Interface GA Plan and Section
BABFAF000-01717-2100-45306 Rev 01	TS North Ramp Tunnel Utilities GA Section
BABFAH000-01717-2100-45311 Rev 00	Subsurface Fire Protection System Sections
BABFA0000-01717-2100-45315 Rev 00	Cross-Drift Non-Potable Water System Sheet 1 of 1
YMP-025-1-CIVL-PL140 Rev. 01	North Portal Pad Water Supply Plan

4.5 Results:

4.5.1 The SFWS/SNPWS as-constructed piping was not installed per the baseline drawings. The design interface manifold station on the north side of the portal entry for the Surface and Subsurface portions of the SFWS/SNPWS was not used. The supply water enters the tunnel on the south side of the portal entry and is supplied from the temporary surface tracer feed tanks. The supply water is metered on the surface before it enters the tunnel. See Section 5.1 for a description of the major components.

4.5.2 The pipe size for the as-constructed SFWS/SNPWS is the same as the baselined design (6-inch diameter).

4.5.3 The designed pipe supports were not used by the Constructor. The as-constructed pipe support brackets utilize three pipe support hooks to support compressed air, construction water, and waste water piping. These brackets are connected by various methods to the steel sets or the tunnel left rib wall. At some locations the brackets are secured directly with bolts and at other locations the brackets are secured to the tunnel wall with pins at various depths. Steel cables were used to support the piping at several locations and the piping rested on the conveyor supports in several other locations. There were no vertical restraints and the installed support saddles were bending under the weight of the pipe. By inspection we determined that the as-constructed supports do not meet the seismic requirements of Appendix A of the ESFDR (Ref. 9.6)

4.5.4 Victaulic type flexible couplings in lieu of welded connections were used to connect the SFWS/SNPWS piping.

4.5.5 The isolation valves on the SFWS/SNPWS supply line are manual butterfly type valves spaced at an average of 160 meters (525 feet) intervals. The design spacing is 275 meters (902 ft). These valves are not UL listed or FM approved for fire protection service. Automatic isolation valves were not installed in the as-constructed system.

4.5.6 Utility station locations are different than the baseline design documents.

4.5.7 Fire hose station locations are different than the baseline design documents. High-pressure flexible hoses are used to connect the fire hose stations to the 6-inch supply line.

4.5.8 High-pressure flexible hoses are used to connect the main 6-inch supply line at construction breaks of the alcove openings.

5. OPERATIONAL REQUIREMENTS

5.1 System Description

The SFWS/SNPWS provides a means to transfer traced non-potable water to the tunnel during construction, operation, and testing phases of the ESF. The non-potable water is supplied to the SFWS/SNPWS by the Surface Portion of the Non-Potable Water System (Reference 9.8) to support construction and testing activities, and to suppress fires in the tunnel. The fire hydrant at location N765042.80 and E570040.41 (Ref 9.1) feeds the tracer mixing tank (Tank No. 1). Transfer pumps (Pump No. 1 & Pump No. 2) transfer traced water to storage tracer feed tanks (Tank No. 2 & Tank No. 3). The capacity of the feed tanks are 10,000 gallons each. The capacity of Pump

Nos. 1 and 2 is 175 gpm and the capacity for Pump No. 3 is 600 gpm. The total discharge head of the three pumps are unknown.

Water use for the as-constructed SFWS/SNPWS system is currently metered on the surface at the transfer pump (Pump No. 3) before it is supplied to the subsurface facilities.

An in-line water booster pump (Pump No. 4) is installed at Station 47+50m and it capacity is 275 gpm;, discharge head is unknown.

5.2 Operating Parameters

Table 5.2-1 Operating Parameters

Operating Parameters	Reference	Discussion
Total subsurface water requirement is 275 gpm: 1. Fire Protection = 150 gpm 2. Construction = 100 gpm 3. Contingency = 25 gpm	9.4	The water requirements are taken from the baseline design analysis (Reference 9.4). The as-constructed system is capable of supplying 600 gpm to the tunnel. The 600 gpm flow capacity for a 6-inch line is within acceptable velocity range (6-8 fps), however the pump is oversized for the current use and operating in-efficiently. **Recommend:** Leave the existing supply pump (Pump No. 3) as is. Replace flexible hoses with carbon steel pipe as shown in Attachment III. If the supply pump needs to be replaced in the future, replace it with a new pump rated at 300 gpm at 400 feet of head.
Water velocity range shall be 4 to 10 fps.	9.4	This parameter is taken from the baseline design. The as-constructed system can operate within this range.

Operating Parameters	Reference	Discussion
Minimum water pressure is 65 psig measured at the fire hose nozzle.	9.4	This parameter is taken from the baseline design. The as-constructed system can satisfy this requirement.
An in-line pump discharge pressure of 176 psig is required to overcome friction losses and to provide 100 gpm of water and 65 psig to all downstream fire hose stations. The pump inlet pressure is 70 psig.	9.4	This parameter is taken from the baseline design. The installed in-line pump at STA 47+50m was an Ingersall Rand, Model B081A, 10HP/31/60Hz, which does not satisfy this parameter. This pump can not adequately supply 100 gpm at 65 psig to the remote fire hose stations in the main loop. **Recommend:** Replace existing in-line pump with two new booster pump rated at 165 gpm and 350 feet of head.
Motor operated indicating isolation valves, with a minimum 10-second closure time will limit the volume of water discharged and prevent water hammer.	9.4	This parameter is taken from the baseline design. Manual isolation valves were installed in the as-constructed system. **Recommend:** Install automatic isolation valve at the discharge of the supply water pump (pump No. 3)
Water consumption is continuously metered. Water consumption and water loss are recorded on a daily basis.. Meters were required at each fire hose station and each utility station where supply water is extracted for construction use.	9.16	This parameter is a QA Control requirement which is performed by the constructor.

5.3 Operating Permits

The same operating permit requirements for the Surface portion of the Non-Potable Water System (Reference 9.18) will apply to the components of the SFWS/SNPWS installed on the surface of the North Portal pad. The operating permit requirements listed in Table 5.3-1 were extracted from the Water Supply Permit issued by the State of Nevada (Ref 9.20)

Table 5.3-1 Operating Permit Requirements

Operating Permit Requirements	**Reference**	**Discussion**
See Reference 9.20, Item 1: Water distribution and sewage collection lines must be laid in separate trenches at least 10 feet apart. In well-drained dry ground where sewage flow is by gravity at greater than 2 feet per second, water lines may be in the same trench on undisturbed earth 6 feet horizontally and 3 feet vertically above the sewer line. Where the water line crosses less than 18 inches over the sewer line or storm drain line, or, when the water line crosses under the sewer or storm drain, or where the horizontal separation, as required by the Public Water System Construction Regulations cannot be maintained because of physical obstructions (buildings), the water line must be protected by construction of the sewer or storm drain line by encasement with 4 inches, minimum of concrete. The concrete must extend for other than 90 degree crossing to the point at which the 10-foot separation between the water and sewer of storm drain lines is achieved.	Ref 9.20	The Surface Non-Potable Water System design accounted for these conditions (depth of burial and layout) and the system was built in accordance with the design drawings. This requirement is not applicable to the SFWS/SNPFS.

Operating Permit Requirements	Reference	Discussion
See Reference 9.20, Item 2: Per NAC 445.410, water distribution and sewage collection lines must be laid in separate trenches at least 10 feet apart. In well-drained dry ground where sewage flow is by gravity at greater than 2 feet per second, water lines may be in the same trench on undisturbed earth 6 feet horizontally and 3 feet vertically above the sewer line, or as approved in writing by the state health officer.	Ref 9.20	The Surface Non-Potable Water System design accounted for these conditions and the system was built in accordance with the design drawings (depth of burial and layout). This requirement is not applicable to the SFWS/SNPFS.
See Reference 9.20, Item 3: Per NAC 445.404, no cross connection may be made so that unsafe water, or water from a source which does not comply with this section may be discharged or drain into any drinking, culinary or ablutionary supply which complies with NAC 445.370 to 445.420, inclusive.	Ref 9.20	These requirements have been met during construction and should continue being implemented during operations.

5.4 Operating ES&H

The operation of the SFWS/SNPWS shall comply with the requirements of 29 CFR 1926 (Ref. 9.13) and M&O Safety and Health Plan (Ref. 9.14).

5.5 Operating Quality Assurance (QA) Controls

The applicable QA controls for the as-constructed SFWS/SNPWS are stated in Article 3.01 of Specification Sections 01500 (Ref 9.15) and 01501 (Ref 9.16). The as-constructed SFWS/SNPWS satisfy QA control requirements.

The accepted SFWS/SNPWS will operate under the QA requirements of References 9.19.1 and 9.19.2.

Table 5.5-1 Operating QA Controls

Operating QA Controls	Reference	Discussion
ESF Surface Facilities: QA controls for reporting tracers, fluids, and materials lost or emplaced during construction, maintenance, and operation of the ESF are described in specification Section 01600.	9.15	This QA control is the responsibility of the Constructor. Kiewit/PB Submittal BAB000000-01717-6300-01600-CD-01-1, Spill Prevention, Control and Countermeasures Plan meets this requirement for TFM reporting. This QA control applies to the surface facilities components that are located on the surface near the North Portal entrance.
ESF Surface Facilities: QA controls for reporting and repair of leaks.	9.17	This QA control is the responsibility of the constructor and documented in Specification 01800. This QA control applies to the surface facilities components that are located on the surface near the North Portal entrance.
ESF Surface Facilities: QA Controls for hydrocarbons spilled or lost in the construction, maintenance, and operation of the ESF are described in Specification Section 01600. These controls require the inspection of fixed equipment, vehicles, and facilities.	9.15	This QA control is the responsibility of the Constructor. Kiewit/PB Submittal BAB000000-01717-6300-01600-CD-01-1, Spill Prevention, Control and Countermeasures Plan meets this requirement. This QA control applies to the surface facilities components that are located on the surface near the North Portal entrance.

Operating Permit Requirements	Reference	Discussion
ESF Subsurface Facilities: QA Control: The use of permanently retained organics during the construction and operation of the TS Tunnel Loop and associated alcoves/niches shall be avoided, when practical alternative materials and methods exit. Potential equipment fluid leaks shall be minimized by performing regular inspections and scheduled maintenance. Spills of organics solvents and powders in excess of drips (e.g. ruptured hoses, spills from reservoirs) shall be cleaned up in accordance with SRP (Para. 3.01M) and disposed of in accordance with Federal and State requirements. Cleanup of liquids shall include removal of puddles and partially saturated soils. Cleanup of powders shall include removal of the powder and sweeping solid surfaces to remove powder remnants. Organic spills on the invert segment need not be removed if it is clear that the spilled material is not likely to penetrate to the tunnel floor or past the invert segment seals. Inverts may be removed or inspection ports drilled after a spill if necessary to facilitate further inspection. Any uncovered organics spilled or permanently retained in the TS Tunnel Loop and associated alcoves/niches shall be reported in accordance with the TFM Data reporting and Management procedure.	9.16	This QA control is the responsibility of the Constructor. Kiewit/PB Submittal BAB000000-01717-6300-01501-CD-28-3, Kiewit/PB Spill Response Plan meets this requirement.

6. BASELINE REQUIREMENTS

6.1 ESFDR REQUIREMENTS - Comparison of the ESFDR to the as-constructed system.

Table 6-1 ESFDR Requirements

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.2.1.2.1.1.A (Surface) The ESF surface facilities and equipment shall be designed with features that minimize the growth of fungus, bacteria, and algae.	N/A	This requirement is not applicable to the SFWS/SNPWS and it is not a criteria in the design analysis.
3.2.1.2.1.1.B (Surface) Earthquake design parameters for surface facilities shall be calculated in accordance with the information in Appendix A, Seismic Design Basis Loads for The Exploratory Studies Facility"	No	The temporary chemical tracer feed system was installed using heavy duty industrial grade equipment, but it was not seismically anchored. **Recommend:** Anchor the chemical tracer feed components to a concrete pad to satisfy seismic and wind load requirements. Change ESFDR, Appendix A seismic criteria from UBC Zone 3 to Zone 2B.
3.2.1.2.1.1.C (Surface) The ESF surface facilities shall be designed to withstand 75 mph (high winds) prevailing winds with maximum gusts up to 97 mph.	No	Wind design does not apply to buried piping and associated equipment. There are some SFWS/SNPWS components located above ground on the surface. These components are not anchored. **Recommend:** See recommendation in 3.2.1.2.1.1.B
3.2.1.2.1.1.D (Surface) The ESF surface facilities and equipment shall be designed with appropriate grounding to withstand and minimize the potential for damage due to a direct lightning strike.	Yes	The SFWS/SNPWS is grounded per Specification 01500 (Reference 9.15).

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.2.1.2.1.1.E (Surface) The ESF surface facilities and equipment shall be designed to withstand maximum daily precipitation levels of 2.18 inches within a 24-hour period.	Yes	The as-constructed SFWS/SNPWS components were manufactured for outdoor use and installed per Specification 01500 (Reference 9.15). The North Portal pad construction satisfies this requirement and the project drainage requirement.
3.2.1.2.1.1.F (Surface) The ESF surface facilities and equipment shall be designed to withstand and operate in temperatures ranging from a low of -14 degrees F to a high of 108 degrees F.	No	Only a portion of the as-constructed SFWS/SNPWS piping is provided with electric heat tracing to prevent freezing. The equipment and piping are manufactured to operates in a desert environment with temperatures reaching 122^0 F. **Recommend:** Heat tracing all of the surface SFWS/SNPWS piping to prevent freezing.
3.2.1.2.1.1.G (Surface) The ESF surface facilities and equipment shall be designed to withstand maximum loads caused by snowfall of 10 inches maximum in a 24-hour period.	Yes	Snow loads will not have an impact on the as-constructed system. Electric heat tracing is recommended on all surface piping to prevent freezing. The equipment and piping are manufactured to operate at low temperatures of -14^0 F.
3.2.1.2.1.1.H (Surface) The ESF surface facilities and equipment shall be designed to withstand and operate in a relative humidity environment of 13 to 71%.	Yes	The as-constructed surface components have operated effectively in this relative humidity range. The equipment and piping are manufactured to operate in outdoor desert environment of humidity rage from 0 - 100%.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.2.1.2.1.1.I (Surface) The ESF surface facilities and equipment shall be designed to withstand the loads caused by a 100 year probable maximum flood local storm identified in the *Reference Information Base*, YMP/93-02.	Yes	The facilities are located outside the probable maximum flood area as specified in the drawings.
3.2.1.2.1.1.J (Surface) The ESF surface facilities and equipment shall be designed to withstand and operate in an environment with sand and dust.	Yes	Sand and dust have no impact on the as-constructed system. The as-constructed surface components have operated effectively in this dusty environment.
3.2.1.2.1.2.A (Subsurface) The permanent and temporary items of the ESF shall be designed to withstand the applicable seismic environment specified in Appendix A.	No	The A/E piping supports were designed in accordance with Appendix A. Design analysis (Ref. 9.8) supports the design as documented on structural drawings BABEAC000-01717-2100-41110 (Ref. 9.1.3) and 41111 (Ref. 9.1.4). The as-constructed pipe supports do not have vertical restraint straps. These supports do not satisfy the requirements. **Recommend:** Revise ESFDR to reflect that utility supports will prevent the system from becoming a personnel safety hazard during a seismic event. Change ESFDR, Appendix A seismic criteria from UBC seismic Zone 3 to Zone 2B. Install seismic restraints to prevent detachment of the piping from the existing pipe support brackets.
3.2.1.2.1.2.B (Subsurface) The ESF subsurface facilities and equipment shall be designed to withstand and operate in a dusty environment.	Yes	Subsurface SFWS/SNPWS is not affected by dust because subsurface components were manufactured to operate in a dusty environment.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.2.1.2.1.2.C (Subsurface) The ESF subsurface facilities and equipment shall be designed to withstand and operate in temperatures ranging from low 50 degrees F to high 70 degrees F.	Yes	SFWS/SNPWS is designed to operate in this temperature range. (Ref. 9.5) The equipment is industrial grade piping valves, fire hose stations, and associated equipment manufactured to operate in a temperature range of 40^0 F to 122^0 F.
3.2.1.2.1.2.D (Subsurface) The ESF subsurface facilities and equipment shall be designed to withstand and operate in a relative humidity environment of 13% to 71%.	Yes	SFWS/SNPWS is not affected by humidity. The SFWS/SNPWS will operate in this humidity range. (Ref. 9.5)
3.2.1.2.2.A (General) The ESF non-permanent items shall be designed for a 25-year maintainable service life.	Yes	The SFWS/SNPWS is designed for a 25-year maintainable life. The as-constructed SFWS/SNPWS is made of industrial grade materials and is easily accessible and maintainable.
3.2.1.2.2.B (General) The ESF permanent items shall be designed for a 150-year maintainable service life.	N/A	The SFWS/SNPWS is considered a part of the temporary facilities, not permanent items.
3.2.1.2.3. (Constraints) ESF Constraints 3.2.1.2.3.A, 3.2.1.2.3.B, 3.2.1.2.3.C, 3.2.1.2.3.D, 3.2.1.2.3.E, 3.2.1.2.3.F, 3.2.1.2.3.G, 3.2.1.2.3.H, and 3.2.1.2.3I	Yes	Subsurface General Construction Specification, Document BAB000000-01717-6300-01501 REV 05 (Ref 9.16) provides the requirements for subsurface construction activities including construction equipment and materials. This document was provided in part to satisfy the ESF constraints.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.2.1.2.4.A (General) The ESF shall be designed in compliance with the applicable requirements contained in Uniform Building Code.	No	The A/E piping supports were designed in accordance with Appendix A. Design analysis (Ref. 9.8) supports the design as documented on structural drawings BABEAC000-01717-2100-41110 (Ref. 9.1.3) and 41111 (Ref. 9.1.4). The as-constructed pipe supports do not have vertical restraint straps. These supports do not satisfy the requirements. **Recommend:** Revise ESFDR to reflect that utility supports will prevent the system from becoming a personnel safety hazard during a seismic event. Change ESFDR, Appendix A seismic criteria from UBC seismic Zone 3 to Zone 2B. Install seismic restraints to prevent detachment of the piping from the existing pipe support brackets.
3.2.1.2.4.B (General) The ESF shall be designed in compliance with the applicable requirements contained in ACI 318 Building Code Requirements for reinforced concrete	N/A	ACI 318 is mainly for building type structures and does not apply to the SFWS/SNPWS.
3.2.1.2.4.C (General) The ESF shall be designed in compliance with the applicable requirements contained in DOE Order 6430.1A	No	The SFWS/SNPWS meets the general requirements of DOE 6430.1A, Division 15 for process water supply use. However, the fire hose stations system performance is not in compliance with DOE 6430.1A or DOE Order 420.1. The location of the fire hose stations are acceptable as stated in the FHA (Ref. 9.5). **Recommend:** Replace flex hose connections with carbon steel piping

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.2.1.2.4.D (General) The ESF shall be designed in compliance with the applicable requirements contained in DOE Order 5480.7A	No	DOE Order 5480.7A is no longer a valid document. DOE Order 5480. 7a is replaced by DOE Order 420.1, Facilities Safety. The location of the fire hose stations are acceptable as stated in the FHA (Ref. 9.5). **Recommend:** Update the ESFDR to replace all reference to DOE Order 5480.7a with DOE Order 420.1. Replace flex hose connections with carbon steel piping.
3.4.5.1.2.A (Surface) The surface utility systems shall not unnecessarily restrict foot, vehicular, or ramp portal and/or shaft collar traffic; obstruct ventilation; or cause health and safety concerns.	Yes	SFWS/SNPWS was constructed so that there are no restrictions or obstructions.
3.4.5.1.2.B (Surface) The surface utilities shall be designed to provide the minimum utility services such as power, potable water, fire protection water, communications, and sanitary waste, to each surface facility building.	N/A	This requirement is not applicable to the SFWS/SNPWS. Fire water requirements for the surface facility buildings are addressed in the Surface Portion of the Non-Potable Water System TER.
3.4.5.1.2.C (Surface) The service facilities and equipment required for maintaining and installing underground services shall be provided to support ESF operation and in situ site characterization.	Yes	The as-constructed SFWS/SNPWS satisfies this requirement. The as-constructed system supports ESF operations, construction, and testing activities.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.4.5.1.2.D (Surface) The surface utilities shall be designed to provide the minimum utilities identified in the surface utility analysis.	N/A	Surface utilities are addressed in the Surface Portion of the Non-Potable Water System TER (Ref. 9.18).
3.4.5.1.2.E (Surface) An analysis shall be conducted by the design organization to determine what utilities are required for the surface facilities.	Yes.	Utility requirements are listed in Section 3.4.5.1.1.B of the ESFDR.
3.8.1.2.C (Subsurface) The service facilities and equipment required for maintaining underground services shall be provided to support ESF operation and in situ characterization.	Yes	The as-constructed SFWS/SNPWS satisfies this requirement for the water supply and fire protection for underground site characterization testing program during ESF operations.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.8.2.1.1.A (Subsurface) The ESF shall provide underground utilities, which includes as a minimum: • Power, • Communications, • Lighting, • Ventilation, • Water, • Underground waste water removal, • Compressed Air, • Fire Protection, • Materials and rock and muck handling, • Sanitation, and • Safety monitoring and warning subsystems, required to meet the needs of the underground site characterization testing program during ESF operations.	Yes	The as-constructed SFWS/SNPWS including portable fire extinguishers satisfies this requirement for the water supply and fire protection for underground site characterization testing program during ESF operations.
3.8.2.1.2.A (Subsurface) The underground utilities for the ESF shall not preclude montoring and investigation of in situ testing.	Yes	The as-constructed SFWS/SNPWS supports the monitoring and investigation of in situ testing. The operation of the as-constructed SFWS/SNPWS does not prevent monitoring and testing activities in the tunnel.
3.8.2.1.2.B (Subsurface) Subsurface utility systems, when installed, shall not restrict foot, vehicular, or shaft and ramp conveyance traffic.	Yes	The as-constructed SPWS/SNPWS does not restrict personnel or vehicular traffic. Also, there are no interferences with the Surface or Subsurface Conveyor System, or the piping, pipe supports, and fire hose stations mounted on the wall.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.8.2.1.2.C (Subsurface) Subsurface utilities systems, when installed, shall not obstruct ventilation.	Yes	The as-constructed SFWS/SNPWS does not interfere with the tunnel ventilation system in the main drift or alcoves.
3.8.2.1.2.D (Subsurface) To the extent practical, underground utility systems and associated furnishings (hangers, brackets, etc.) Shall be removed following final use.	Yes	The SFWS/SNPWS will be dismantled when the ESF activities are completed. The SFWS/SNPWS has been constructed to accommodate removal after ESF activities are completed.
3.8.2.1.2.E (Subsurface) The distribution of utilities shall support flexibility in the siting of the final testing locations.	Yes	The as-constructed SFWS/SNPWS is currently meeting this requirement. The installation of utility stations along the SFWS/SNPWS piping allows for flexibility to provide non-potable water to various test locations in the tunnel.
3.8.2.1.2.F (Subsurface) Subsurface utilities requiring remote monitoring and control shall provide the necessary equipment to interface with the subsurface monitoring and control system and the IDCS.	No	Daily water for the as-constructed SFWS/SNPWS is controlled and monitored in accordance with Specification -01501 (Reference 9.16). The scope of the IDCS has changed and data collection for the SFWS/SNPWS is not included in the current DCS (formerly named IDCS). The intent of this requirement is met because monitoring and control of the SFWS/SNPWS is performed by daily recording water use measured by the water meters. **Recommend:** Revise this ESFDR requirement to delete reference to the IDCS and remote monitoring and control.
3.8.2.1.2.G (Subsurface) Subsurface utilities shall support the testing utility requirements in Appendix B.	Yes	The water usage identified in Attachment II support construction and testing in the tunnel as defined in Appendix B. TFM records identifying water use per activity are available.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.8.2.6.1.A (Subsurface) Management of water entering the ESF shall include quantity and water balance.	Yes	The as-constructed SFWS/SNPWS satisfies this requirement. Supply is metered on the surface at the supply pump discharge and the waste water is metered at the surface collection tank. Daily construction records of water use and recovery are available.
3.8.2.6.1.B (Subsurface) Piping shall be designed to preclude or limit water inflow into the ESF following a pipe rupture.	No	Non UL listed or FM approved manual isolation valves were installed approximately every 525 feet to limit the amount of spilled water caused by a pipe rupture when observed. **Recommend:** Install automatic isolation valve at the supply pump discharge to limit water inflow into the ESF following a pipe rupture.
3.8.2.6.1.C (Subsurface) All joints in fluid-carrying columns shall be sealed and proof tested.	Yes	The as-constructed SFWS/SNPWS satisfies this requirement. All joints were installed with mechanical seals and utility stations were installed with manual isolation valves. SFWS/SNPWS piping was tested in accordance with Specification 01501.
3.8.2.6.1.D (Subsurface) Fluid-carrying piping shall be designed to prevent damage cause by water hammer.	Yes	The baselined design provides automatic air vents which help prevent water hammer. In the as-constructed SFWS/SNPWS no automatic air vents are provided. However it must be noted that the as-constructed system has no automatic shutoff valves or any other fixtures which could suddenly close in a way that could cause water hammer. **Recommend:** Leave as-constructed tunnel piping as is. Manual valves will be shown on as-built drawings. An automatic isolation valve will be installed on the surface. The installation of the automatic isolation valve will be designed to prevent water hammer damage.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.8.2.6.1.E (Subsurface) All water used underground during operation and construction of the ESF shall be provided with chemical tracers as required by testing.	Yes	The as-constructed system satisfies this requirement. The supply water is chemical traced on the surface in the temporary tracer feed tank before it is supplied to the tunnel.
3.8.2.6.1.F (Subsurface) The water distribution system shall be of sufficient size and capacity to simultaneously provide for fire protection and process water through the ESF, in accordance with all anticipated needs and services for ESF subsurface operations.	Yes	The as-constructed SFWS/SNPWS satisfies this requirement. The as-constructed system supplied adequate non potable water to support ESF subsurface operations. (Ref. 9.5) See Attachment II.
3.8.2.6.1.G (Subsurface) The subsurface water system shall have a minimum availability of 98.94%.	No	The SFWS/SNPWS is currently providing the necessary ESF support to construction and testing activities as installed. If the as-constructed system fails or become inoperable, the current remedies to restore service is sufficient and therefore this availability requirement does not serve a useful purpose at this time. **Recommend:** Delete ESFDR requirement.
3.8.2.6.1.H (Subsurface) The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.	Yes	A/E analysis estimates peak ground-water flow for infiltration at 250 gpm occurring for 30 minutes, for a total of 7500 gallons (Ref. 9.6). TFM tunnel water reports show that the subsurface water loss are within the boundaries of the analysis.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.8.2.9.1.A (Subsurface) Water shall be used as the fire-suppressing agent only after detailed analysis has been made of its effects on overall site characterization and individual testing activities.	Yes	The Subsurface Fire Protection Design Analysis (Ref. 9.4), the Subsurface Fire Hazards Analysis (Ref. 9.5) and the DIE (Ref. 9.19.1) satisfies this requirement to justify the use of water as the fire-suppressing agent.
3.8.2.9.1.B (Subsurface) The underground portion of the ESF shall incorporate a fire protection system to detect, warn, control, and limit the impact of credible fires in the ESF.	No	There are currently limited warning or detection systems within the ESF. However, per ECR E98-0064 work is in process to implement recommendations provided in the FHA (Ref. 9.5). **Recommend:** Revise ESFDR to reflect fire safety requirements described in ECR E98-0064.
3.8.2.9.1.C (Subsurface) Reserved	N/A	This requirement has been deleted.
3.8.2.9.1.D (Subsurface) If water is used as a fire suppressant, the distribution system shall have, as a minimum, fire hose outlets located along the main access openings at intervals to meet the applicable safety requirements.	Yes	The as-constructed SFWS/SNPWS satisfies this requirement. Fire hose stations are located at the entrance of each alcove. As described in the FHA (Ref. 9.5) water is the secondary suppressant agent in the tunnel. This requirement is satisfied.
3.8.2.9.1.E (Subsurface) The subsurface fire protection system shall have a minimum availability of 99.14%.	No	The SFWS/SNPWS is not the primary fire suppression agent and it is not required for personnel safety. The primary fire suppression agents are portable multipurpose dry chemical extinguishers, which are placed at approximately 200-foot interval along the length of the tunnel. Specifying an availability requirement on commercial grade fire extinguishers is not necessary and has not been calculated. This requirement should be deleted. **Recommend:** Delete ESFDR requirement.

ESFDR REQUIREMENTS		
ESFDR Requirement	**Satisfied ?**	**Description**
3.8.2.9.1.F (Subsurface) Fire suppression agents shall be selected for compatibility with intended use and approved for use based on their impacts on the in situ site characterization testing program.	Yes	The as-constructed SFWS/SNPWS satisfies this requirement. Fire water and fire extinguishers used in the ESF were selected based on the FHA (Ref. 9.5) and DIE (Ref. 9.19.1).

6.2 AS-CONSTRUCTED DEVIATIONS AND RECOMMENDATIONS

Table 6-2 As-Constructed Deviations and Recommendations

As-Constructed Deviations and Recommendations		
As-Constructed Deviations	**Design Documents**	**Recommendations**
The surface/subsurface interface for the non-potable water system is different from the baseline drawings. Supply water to the tunnel is taken from a fire hydrant pumped through the temporary tracer feed tanks and pumped underground. See Paragraph 5.1 for system description.	Ref. 9.4	Complete the construction work to connect the Surface Non-Potable Water System to the SFWS/SNPWS. Install new connection from the underground Surface Non-Portable Water main to the as-constructed chemical feed tanks. The surface/subsurface interface will be at this new connection. Abandon the baseline design surface/subsurface interface and chemical injection system. The OQA batch monitoring to control tracer mixture in the chemical feed tank will continue for the duration of the ESF. See paragraph 4.5.1.
The Subsurface Fire Protection A/E design was not installed.	Ref. 9.3 Ref. 9.5 Ref. 9.6	Leave the existing main supply pump (Pump No. 3) as is. Replace all flexible hoses on the surface with carbon steel pipe as shown in Attachment III. Replace the existing in-line pump (Pump No. 4) with two new booster pumps at STA 47&50M rated at 165 gpm and 200 feet of head.

As-Constructed Deviations and Recommendations		
As-Constructed Deviations	**Design Documents**	**Recommendations**
The SFWS/SNPWS piping is different from the baselined design. High-pressure flex hoses are used to connect fire hose stations to the main supply line and to connect the main supply line at alcove entrances.	Ref. 9.7	Accept steel piping including non UL listed or FM approved valves and fittings as installed. Replace flex hoses with carbon steel pipe. The Constructor's drawings (Ref. 9.3) are available. See paragraphs 4.5.2, 4.5.4, 4.5.5, 4.5.6, 4.5.7 and 4.5.8.
MGDS Safety Assurance Department availability calculations are based on A/E design equipment and components specified. The as-constructed system is different and does not use the specified hardware.	Ref. 9.3 Ref. 9.9	Availability analysis is no longer required for the SFWS/SNPWS because the MGDS Safety Assurance Department has determined that this system is not critical to the operation of the ESF. The SFWS/SNPWS is not the primary fire suppression agent and it is not required for personnel safety. The primary fire suppression agents are portable multipurpose dry chemical extinguishers, which are placed at approximately 200-foot interval along the length of the tunnel. Revise ESFDR to reflect that availability calculations are not required for the SFWS/SNPWS.
A/E design specified pipe supports to meet seismic requirements of Appendix A. The constructor did not use pipe supports specified.	Ref. 9.8	Install seismic restraints to prevent detachment of the piping from the existing pipe support brackets. See paragraph 4.5.3.

7. RECOMMENDATIONS

7.1 Provide a new supply water connection to the chemical tracer feed tanks from the 10-inch buried fire water line on the surface of the North Portal Pad. Remove the existing flexible line from the fire hydrant at location N 765042.80 and E 570040.41 and place the fire hydrant back into service. Use the installed chemical tracer injection system and surface piping to the tunnel. The surface/subsurface interface will be at the discharge of the supply water pump (Pump No. 3). Add automatic isolation valve at the supply pump discharge to limit water inflow into the ESF following a pipe rupture. Heat trace all surface piping to prevent freezing. Abandon and disassemble baseline metering station at location N 765339.69 and E 569895.96. (ESFDR 3.2.1.2.1.1.F; ESFDR 3.8.2.6.1.B, ESFDR 3.8.2.1.D; Table 5.2-1, Item 6; Table 6-2, Item 1)

7.2 Leave as-constructed main tunnel piping and utility stations as is. Replace all high pressure flexible hoses with carbon steel pipe. (ESFDR 3.2.1.2.4.C, ESFDR 3.2.1.2.4.D, ESFDR 3.8.2.6.1.D; Table 5.2-1, Item 4;Table 6-2, Item 3)

7.3 Delete availability requirements for the SFWS/SNPWS because the system does not impact personnel safety and the system is not required to function after an earthquake. (ESFDR 3.8.2.6.1.G, ESFDR 3.8.2.9.1.E; Table 6-2, Item 4)

7.4 Install seismic restraints to existing pipe support brackets to prevent detachment of the SFWS/SNPWS piping. (ESFDR 3.2.1.2.1.2.A, ESFDR 3.2.1.2.4.A; Table 6-2, Item 5)

7.5 Construct concrete pad to anchor chemical tracer feed components to satisfy seismic and wind criteria for the surface equipment. (ESFDR 3.2.1.2.1.1.B, ESFDR 3.2.1.2.1.1.C; Table 5.2-1, Item 1; Table 5.2-1, Item 5; Table 6-2, Item 2)

Leave the existing main supply pump (Pump No. 3) as is. Replace all flexible hoses on the surface with carbon steel pipe as shown in Attachment III. Replace the existing in-line pump (Pump No. 4) with two new booster pumps at STA 47+50M rated at 165 gpm and 200 feet of head.

7.6. Revise ESFDR requirement to delete reference to the IDCS. (ESFDR 3.8.2.1.2.F)

7.7 Revise ESFDR seismic requirement in Appendix A to be consistent with ECRB seismic requirement. Change from UBC Zone 3 seismic criteria to Zone 2B. (ESFDR 3.2.1.2.1.2.A, ESFDR 3.2.1.2.4.A; Table 6-2, Item 5)

8. COST AND SCHEDULE ESTIMATE

8.1 Engineering: Develop four equipment data sheets and redesign connection to chemical feed tanks, and design seismic restraints for tunnel pipe supports 520 M/Hs; $41, 600.00 (See Attachment I). Work will be performed in FY99.

8.2 The cost for recommended ESFDR changes are included in the cost of the general revision of the ESFDR.

8.3 Construction Work:

8.3.1 Install new supply water connection to the chemical tracer feed tanks and provide electric heat tracing on surface piping. Construction cost is $6,788.00 (See Attachment I).

8.3.2 Replace the high-pressure flexible (rubber) hose with carbon steel pipe. Construction cost is $7,276.00 (see Attachment I).

8.3.3 Install seismic restraints to prevent detachment of the piping from the existing pipé support brackets. Construction cost is $40,148.00 (See Attachment I).

8.3.4 Install two new booster pumps in the tunnel and concrete foundation on the surface for the chemical mixing tanks and pumps. Construction cost is $26,858.00. (See Attachment I)

8.4 Estimates to develop SFWS/SNPWS As-Built documents are not included in this report.

9. REFERENCES

9.1 M&O Drawings

9.1.1	BABFAF000-01717-2100-20028 Rev 05,	North Portal Plan Utility Plan
9.1.2	BABFAF000-01717-2100-20030 Rev 06,	North Portal Pad Utility Plan
9.1.3	BABEAC000-01717-2100-41110 Rev 01,	TS North Ramp Piping Brackets Plan, Elevations, Details
9.1.4	BABEAC000-01717-2100-41111 Rev 01	TS North Ramp Piping Brackets Installation
9.1.5	BABFAE000-01717-2100-45301 Rev 01,	Subsurface Water Distribution System Flow Diagram
9.1.6	BABFA0000-01717-2100-45304 Rev 01,	SS/Surf Interface GA Plan and Section
9.1.7	BABFAF000-01717-2100-45306 Rev 01,	TS North Ramp Tunnel Utilities GA Section
9.1.8	BABFAH000-01717-2100-45311 Rev 00,	Subsurface Fire Protection System Sections
9.1.9	BABFA0000-01717-2100-45315 Rev 00,	Cross-Drift Non-Potable Water System Sheet 1 of 1
9.1.10	YMP-025-1-CIVL-PL140 Rev 01	North Portal Pad Water Supply Plan

9.2 REECO Sketches

9.2.1 YMPFWLN.DWG Fire Water Line As-Built Locations Sht 1 of 3
9.2.2 YMPFWLN2.DWG Fire Water Line As-Built Locations Sht 2 of 3

9.2.3 YMPFWLN3.DWG Fire Water Line As-Built Locations Sht 3 of 3
9.2.4 ESF1095A.DWG ESF Pad Working Drawing

9.3 Kiewit/PB Drawings

9.3.1 tunaba.dwg: ESF-TS North Ramp Utilities - As-Built STA 0+00 to 5+00
9.3.2 tunabb.dwg: ESF-TS North Ramp Utilities - As-Built STA Alcove #1-Alcove #2
9.3.3 tunabc.dwg: ESF-TS North Ramp Utilities - As-Built STA 5+00 to 10+00
9.3.4 tunabd.dwg: ESF-TS North Ramp Utilities - As-Built STA 10+00 to 15+00
9.3.5 tunabf.dwg: ESF-TS North Ramp Utilities - As-Built STA Alcove #3 - Alcove #4
9.3.6 tunabg.dwg: ESF-TS North Ramp Utilities - As-Built STA 15+00 to 20+00
9.3.7 tunabh.dwg: ESF-TS North Ramp Utilities - As-Built STA 20+00 to 25+00
9.3.8 tunabi.dwg: ESF-TS North Ramp Utilities - As-Built STA 25+00 to 30+00
9.3.9 tunabj.dwg: ESF-TS North Ramp Utilities - As-Built STA Alcove #5
9.3.10 tunabk.dwg: ESF-TS North Ramp Utilities - As-Built STA 30+00 to 35+00
9.3.11 tunabl.dwg: ESF-TS North Ramp Utilities - As-Built STA 35+00 to 40+00
9.3.12 tunabm.dwg: ESF-TS North Ramp Utilities - As-Built STA Alcove #6
9.3.13 tunabn.dwg: ESF-TS North Ramp Utilities - As-Built STA 40+00 to 45+00
9.3.14 tunabo.dwg: ESF-TS North Ramp Utilities - As-Built STA 45+00 to 50+00
9.3.15 Tunnel2.dwg: ESF Tunnel Progress

9.4 Subsurface Fire Protection Design Analysis, BABFAH000-01717-0200-00114 Rev 00

9.5 Subsurface Fire Hazards Analysis, BABFAH000-01717-0200-00121 Rev 01

9.6 Exploratory Studies Facility Design Requirements (ESFDR), Document No. YMP/CM-0019 Rev 02 ICN 1

9.7 Not used

9.8 ESF Subsurface Piping Design Support Calculation, Document No. BABEAC000-01717-0200-00002 Rev 01

9.9 SD & TRD Availability TBD Resolution Analysis, Document No. BA0000000-01717-0200-00001 Rev 01

9.10 Chemical Tracer Injection System Analysis for Constructions Process and Firewater Usage, BABFAE000-01717-0200-00030 Rev 01

9.11 Subsurface Fire Hose Station Analysis, BABFAH000-01717-0200-00001 Rev 00

9.12 Not used

9.13 29 CFR 1926, Safety and Health Regulations for Construction

9.14 M&O Safety and Health Plan, Document No. B00000000-01717-4600-00016 Rev 02

9.15 Specification Section 01500, Temporary Surface Construction Facilities, Document No. BAB000000-01717-6300-01500 Rev 01

9.16 Specification Section 01501, Subsurface General Construction, Document No. BAB000000-01717-6300-01501 Rev 05

9.17 Specification Section 01800, Maintenance and Operation of Surface Facilities, - Document No. BAB000000-01717-6300-01800 Rev 01

9.18 Surface Portion of the Non-Potable Water System TER, BABBDB000-01717-5705-00001 Rev 1B

9.19 Determination of Importance

9.19.1 DIE For The Subsurface Exploratory Studies Facility, BAB000000-01717-2200-00005 Rev 06/1CN1

9.19.2 DIE For Surface Exploratory Studies Facility, BAB000000-01717-2200-00106 Rev 02

9.19 Letter dated September 3, 1993 from the Sate of Nevada, Department of Human Resources. (Tinney to Dixon)

ATTACHMENTS

I. Cost Estimate

II. SFWS/SNPWS Supply Water Data

SFWS/SNPWS COST ESTIMATE

Summary Account Number: 126D2465MD-2N6068

Summary Account Title: TER ESTIMATE FOR THE SUBSURFACE FIRE WATER SYSTEM AND SUBSURFACE PORTION OF THE NON-POTABLE WATER SYSTEM

Discipline: All (Surface and Subsurface)

SOW (All): Engineering estimate to issue new equipment data sheets for the purpose of turning over the SFWS/SNPWS to M&O Operations. Work includes redesigning the chemical injection equipment for the SFWS/SNPW on the surface.

Engineering Estimate:

ESF Design	M/Hs	Product Ck'g (M/Hs)
Develop Equipment Data Sheets (4)	40	4
Design New Connection	80	8
Design Seismic Restraints	120	16
Develop Seismic Restraint Dwgs (2)	160	16
SUBTOTAL	400	40
Planning & Supervision (10%)	40	
Design Review (5%)	20	
Title III Submittal Review (5%)	20	
SUBTOTAL	480	40
TOTAL		520 M/Hs

Engineering Budget Estimate: $80.00/M/H X 520 M/Hs = $41,600.00

Construction Estimate:

Installation of Pipe Restraints (Recommendation 7.4)

Total Restraints 1285
90% of existing supports are ok (1156)
10% of existing supports needs new anchor bolts (129)
*Restraints - 5 restraints/hr
1285/5=257 crew-hr
*Anchor bolts - 5 bolts each set-up
129 bolts /5 bolts per set-up = 26 set-ups
set-up 2 hr x 26=52 crew-hr
drill install =5min x 129/60m/hr
=11 crew-hr
*Total crew-hrs
257+52+11=320 crew-hr
*Total mhrs+320 crew-hr x 2 men crew
=640 mhrs

*Labor=640 mhrs x 50$/mhrs	$32,000.00	
*Mat'l cost=$3.50/restraint x 1285	$4,498.00	
Material/Labor Cost (Cost/RestraintxNo. of Restraints)	$36,498.00	
10% Contingency	$3,650.00	
Total Pipe Support Cost		$40,148.00

Install New Water Connection (Recommendation 7.1)

Material Cost	$1,000.00	
Electric Heat Tracing	$2,000.00	
Labor Cost	$3,168.00	
Material/Labor Cost	$6,168.00	
10% Contingency	$620.00	
Total Connection Cost		$6,788.00

Installation of Steel Pipe for Fire Hose Stations and Main Supply (Recommendation 7.2)

Material Cost (Piping, Fittings, Valves, Hangers)	$1,070.00	
Labor Cost	$5,544.00	
Material/Labor Cost	$6,614.00	
10% Contingency	$662.00	
Total Cost for Pipe Installation		$7,276.00

Install New Pumps (Recommendations 7.5 & 7.6)

Remove Pump No.3	$132.00	
Remove Pump No.4	$396.00	
Material Cost (Pump No. 3, Piping, Vales, Etc.)	$3,400.00	
Material Cost (Pump No. 4A/4B, Piping, Valves, Etc.)	$4,000.00	
Material Cost (Concret Foundation)	$6,000.00	
Labor (Install New Pumps/Pad)	$10,488.00	
Material/Labor Cost	$24,416.00	
10% Contingency	$2,442.00	
Total Pump Installation Cost		$26,858.00

Total Construction Cost $81,070.00

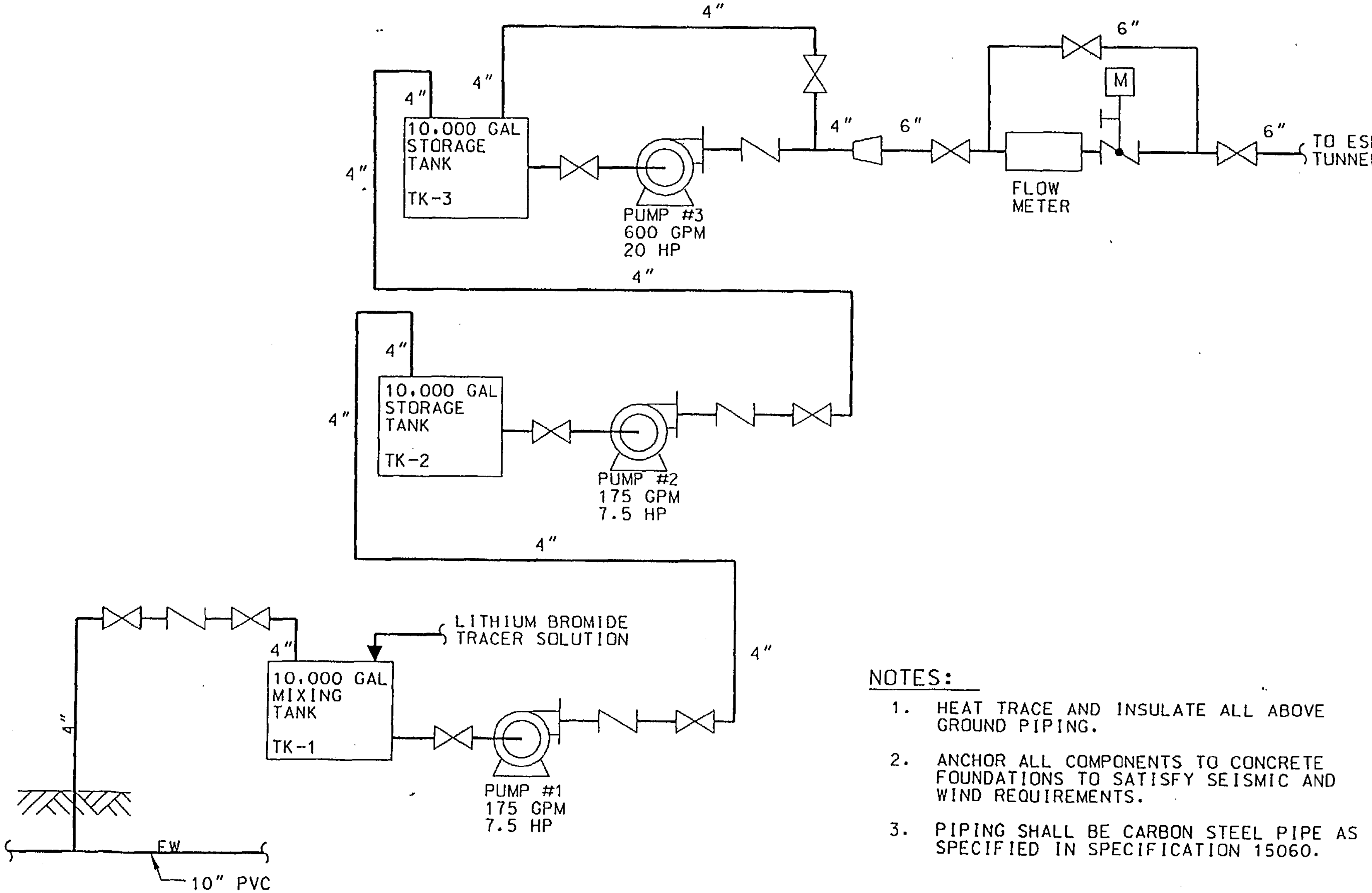
SFWS/SNPWS SUPPLY WATER DATA

	Month (1)	Total Gallons (1)	Working Days (2)	Gal/Days (3)	Gal/Min (4)
1	January 96	885,145 Gallons	20 Days	42,149.76 gpd	43.91 gpm
2	February 96	776,030 Gallons	19 Days	40,843.68 gpd	42.55 gpm
3	May 96	1,151,966 Gallons	21 Days	52,362.09 gpd	54.54 gpm
4	June 96	840,540 Gallons	22 Days	38,206.36 gpd	39.80 gpm
5	January 97	789,434 Gallons	20 Days	37,592.10 gpd	39.16 gpm
6	February 97	821,938 Gallons	19 Days	43,259.89 gpd	45.06 gpm
7	May 97	462,941 Gallons	21 Days	23,147.05 gpd	24.11 gpm
8	June 97	295,011 Gallons	22 Days	13,409.59 gpd	13.97 gpm
9	January 98	130,193 Gallons	20 Days	6,509.65 gpd	6.78 gpm
10	February 98	25,091 Gallons	19 Days	1,320.58 gpd	1.38 gpm
11	March 98	46,800 Gallons	22 Days	2,127.27 gpd	2.22 gpm
12	April 98 (1-19)	148,174 Gallons	13 Days	11,398.00 gpd	11.87 gpm

Notes:

(1) Data input from taken from Design Input Transmittal No. CMO-21, dated July 8, 1998.
(2) Working days represent number of working days per stated month.
(3) Gallons/Day (gpd) = Total Gal/Mo/Number of working days.
(4) Gallons/Minute (gpm) = gpd x .5*/8 hr (shift)/60 min/hr.
* Assume 1/2 of gpd is use on the first shift

SFWS/SNPWS TRACER WATER SUPPLY



NOTES:

1. HEAT TRACE AND INSULATE ALL ABOVE GROUND PIPING.
2. ANCHOR ALL COMPONENTS TO CONCRETE FOUNDATIONS TO SATISFY SEISMIC AND WIND REQUIREMENTS.
3. PIPING SHALL BE CARBON STEEL PIPE AS SPECIFIED IN SPECIFICATION 15060.